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whose data is actually stored in RAM memory. A special program allows the operating system to read from and write to the simulated device as if it were a disk drive. RAM disks are extremely fast, but they require that system memory be given up for their use. Also, RAM disks usually use volatile memory, so the data stored on them disappears when power is turned off. Many portables offer RAM disks that use battery-backed CMOS RAM to avoid this problem. *See also* CMOS RAM. *Compare* disk cache.

RAM refresh \ram´ rē-fresh`, R`A-M´\ *n.* *See* refresh (definition 2).

RAM resident \ram´ rez`ə-dənt, R-A-M´\ *adj.* *See* memory-resident.

RAM-resident program \ram´rez-ə-dent prō`gram, R`A-M´\ *n.* *See* terminate-and-stay-resident program.

random access \ran`dəm ak´ses\ *n.* The ability of a computer to find and go directly to a particular storage location without having to search sequentially from the beginning location. The human equivalent of random access would be the ability to find a desired address in an address book without having to proceed sequentially through all the addresses. A computer's semiconductor memory (both RAM and ROM) provides random access. Certain types of files stored on disk under some operating systems also allow random access. Such files are best used for data in which each record has no intrinsic relationship to what comes physically before or after it, as in a client list or an inventory. *Also called* direct access. *See also* RAM, ROM. *Compare* indexed sequential access method, sequential access.

random access memory \ran`dəm ak-ses mem´-ər-ē\ *n.* *See* RAM.

random noise \ran`dəm noiz`\ *n.* A signal in which there is no relationship between amplitude and time and in which many frequencies occur randomly, without pattern or predictability.

random number generation \ran`dəm num`bər jen-ər-ā`shən\ *n.* Production of an unpredictable sequence of numbers in which no number is any more likely to occur at a given time or place in the sequence than any other. Truly random number generation is generally viewed as impossible. The process used in computers would be more properly called "pseudorandom number generation."

range \rānj\ *n.* **1.** A block of cells selected for similar treatment in a spreadsheet. A range of cells can extend across a row, down a column, or over a combination of the two, but all cells in the range must be contiguous, sharing at least one common border. Ranges allow the user to affect many cells with a single command—for example, to format them similarly, enter the same data into all of them, give them a name in common and treat them as a unit, or select and incorporate them into a formula. **2.** In more general usage, the spread between specified low and high values. Range checking is an important method of validating data entered into an application.

range check \rānj´ chek\ *n.* In programming, a limit check of both the upper and lower limits of a value, thus determining whether the value lies within an acceptable range. *See also* limit check.

RARP \R`A-R-P´\ *n.* Acronym for Reverse Address Resolution Protocol. A TCP/IP protocol for determining the IP address (or logical address) of a node on a local area network connected to the Internet, when only the hardware address (or physical address) is known. While RARP refers only to finding the IP address and ARP technically refers to the opposite procedure, ARP is commonly used for both senses. *See also* ARP.

RAS \R`A-S´\ *n.* *See* remote access server, Remote Access Service.

raster \ra´stər\ *n.* A rectangular pattern of lines; on a video display, the horizontal scan lines from which the term *raster scan* is derived.

raster display \ra´stər dis-plā`\ *n.* A video monitor (typically a CRT) that displays an image on the screen as a series of horizontal scan lines from top to bottom. Each scan line consists of pixels that can be illuminated and colored individually. Television screens and most computer monitors are raster displays. *See also* CRT, pixel. *Compare* vector display.

raster graphics \ra´stər graf`iks\ *n.* A method of generating graphics that treats an image as a collection of small, independently controlled dots (pixels) arranged in rows and columns. *Compare* vector graphics.

raster image \ra´stər im`ə-j\ *n.* A display image formed by patterns of light and dark or differently colored pixels in a rectangular array. *See also* raster graphics.

raster image processor \ra´stər im-ə-j pros´es-ər\ *n.* A device, consisting of hardware and software, that converts vector graphics or text into a raster (bitmapped) image. Raster image processors are used in page printers, phototypesetters, and electrostatic plotters. They compute the brightness and color value of each pixel on the page so that the resulting pattern of pixels re-creates the vector graphics and text originally described. *Acronym:* RIP (rip, R`I-P´).

rasterization \ra`stər-ə-zā´shən\ *n.* The conversion of vector graphics (images described in terms of mathematical elements, such as points and lines) to equivalent images composed of pixel patterns that can be stored and manipulated as sets of bits. *See also* pixel.

raster-scan display \ra´stər-skan dis-plā`\ *n.* *See* raster display.

raw data \rô` dā`tə, dat´ə\ *n.* **1.** Unprocessed, typically unformatted, data, such as a stream of bits that has not been filtered for commands or special characters. *See also* raw mode. *Compare* cooked mode. **2.** Information that has been collected but not evaluated.

raw mode \rô´ mōd\ *n.* A way in which the UNIX and MS-DOS operating systems "see" a character-based device. If the identifier for the device indicates raw mode, the operating system does not filter input characters or give special treatment to carriage returns, end-of-file markers, and linefeed and tab characters. *Compare* cooked mode.

ray tracing \rā´ trā`sēng\ *n.* A sophisticated and complex method of producing high-quality computer graphics. Ray tracing calculates the color and intensity of each pixel in an image by tracing single rays of light backward and determining how they were affected on their way from a defined source of light illuminating the objects in the image. Ray tracing is demanding in terms of processing capability because the computer must account for reflection, refraction, and absorption of individual rays, as well as for the brightness, transparency level, and reflectivity of each object and the

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uses 32-bit code, runs in protected mode, and automatically allocates space in RAM rather than requiring the user to reserve space for the cache. *See also* cache, driver, protected mode, RAM, VFAT.

VCOMM \V¯kom\ *n.* The communications device driver in Windows 95 that provides the interface between Windows-based applications and drivers on one side, and port drivers and modems on the other. *See also* driver.

VCPI \V¯C-P-I¯\ *n. See* Virtual Control Program Interface.

VCR-style mechanism \V-C-R¯-stīl mek´ə-ni-zəm\ *n.* **1.** A user interface for playing movie files that has controls similar to those on a videocassette recorder (VCR). See the illustration. **2.** A type of motorized docking mechanism in which a laptop or notebook computer is physically locked into place by the docking station. The advantage to a VCR-style mechanism is that it provides an electrically consistent, secure bus connection. *See also* docking mechanism, docking station, laptop, portable computer.

VDD \V¯D-D¯\ *n.* Acronym for **v**irtual **d**isplay **d**evice driver. *See* virtual device driver.

VDL \V¯D-L¯\ *n.* Acronym for **V**ienna **D**efinition **L**anguage. A metalanguage, containing both a syntactic and a semantic metalanguage, used to define other languages. *See also* metalanguage.

VDM \V¯D-M¯\ *n. See* video display metafile.

VDT \V¯D-T¯\ *n.* Acronym for **v**ideo **d**isplay **t**erminal. A terminal that includes a CRT (cathode-ray tube) and keyboard. *See also* CRT.

VDU \V¯D-U¯\ *n.* Acronym for **v**ideo **d**isplay **u**nit. A computer monitor. *See also* monitor.

.ve \dot´V-E´\ *n.* On the Internet, the major geographic domain specifying that an address is located in Venezuela.

vector \vek´tər\ *n.* **1.** In mathematics and physics, a variable that has both distance and direction. *Compare* scalar. **2.** In computer graphics, a line drawn in a certain direction from a starting point to an endpoint, both of whose locations are identified by the computer using *x-y*-coordinates on a grid. Vectors are used in the output of some graphics programs instead of groups of dots (on paper) or pixels (on screen). *See also* vector graphics. **3.** In data structures, a one-dimensional array—a set of items arranged in a single column or row. *See also* array, matrix.

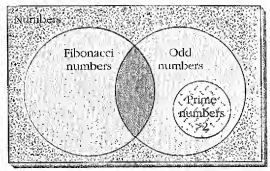
vector display \vek´tər dis-plā¯\ *n.* A CRT (cathode-ray tube), commonly used in oscilloscopes and DVST (direct view storage tube) displays, that allows the electron beam to be arbitrarily deflected, based on *x-y*-coordinate signals. For example, to draw a line on a vector display, the video adapter sends signals to the X and Y yokes to move the electron beam over the path of the line; there is no background composed of scan lines, so the line drawn on the screen is not constructed of pixels. *See also* CRT, yoke. *Compare* raster display.

vector font \vek´tər font¯\ *n.* A font in which the characters are drawn using arrangements of line segments rather than arrangements of bits. *See also* font. *Compare* bitmapped font.

vector graphics \vek´tər graf´iks\ *n.* Images generated from mathematical descriptions that determine the position, length, and direction in which lines are drawn. Objects are created as collections of lines rather than as patterns of individual dots or pixels. *Compare* raster graphics.

vector table \vek´tər tā´bəl\ *n.* See dispatch table.

Venn diagram \ven´ dī´ə-gram\ *n.* A type of diagram, used to express the result of operations on sets, in which a rectangle represents the universe and circles inside the rectangle represent sets of objects. Relationships between sets are indicated by the positions of the circles in relation to one another. The Venn diagram is named after John Venn (1834–1923), an English logician at Cambridge University. See the illustration.



Venn diagram.

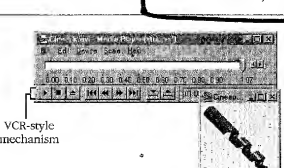
verbose \vər-bōs´\ *adj.* Displaying messages as English text rather than as concise (but cryptic) codes.

verify \vâr´ə-fī¯\ *vb.* To confirm either that a result is correct or that a procedure or sequence of operations has been performed.

Veronica \Vər-on¯ə-ka¯\ *n.* Acronym for **v**ery easy **r**odent-oriented **N**etwide **I**ndex to computerized archives. An Internet service developed at the University of Nevada that searches for Gopher archives by keywords. Users can enter Boolean operators, such as AND, OR, or XOR, to help narrow or expand their search. If any matching archives are found, they are listed on a new Gopher menu. *See also* Boolean operator, Gopher. *Compare* Archie, Jughead.

version \vər´zhən\ *n.* A particular issue or release of a hardware product or software title.

version control \vər´zhən kən-trōl¯\ *n.* The process of maintaining a database of all the source code and related files in a software development



VCR-style mechanism.

Video Engineering

Arch C. Luther
Andrew F. Inglis

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the same time), there isn't much left for audio processing. Dedicated hardware could be used, but the arguments against it are the same as for video.

PC audio formats provide a wide range of performance choices from speech quality up to full audio CD-quality (see Table 1.3). In general, applications should use the lowest quality level that serves their purpose, because higher audio quality costs data space.

Uncompressed audio takes considerably less data than compressed video, so it tends to be more heavily used than video. A single CD-ROM disc can hold only an hour of video, but it can hold 10 or more hours of medium-quality audio. The CD-ROM capacity can only be used once; space taken for audio data subtracts from that available for video. Trading between different data types based on the capacity of a CD-ROM disc is one of the challenges of designing multimedia applications.

15.6.1.3 Text

The original computer interface medium was text and, even in these days of video interfaces, text is still an inescapable medium. It also is very efficient in terms of the data used. Consider that a CD-ROM disc devoted to text can hold upwards of 200,000 pages! Many existing databases are in the form of text and a lot of design effort in the multimedia field has gone into ways to use the video capabilities of computers to give easier access to text.

One very important multimedia text format is known as *hypertext*. With hypertext, words or phrases in a block of text can be made into push buttons (see Figure 15.9). If the user touches one of these words, which are highlighted so he/she can tell they are special, the program branches to a new screen or window that offers additional or related information about the subject of the word touched. For example, when reading a biography of a person, the person's birthplace may be mentioned. If the birthplace name is hypertext, the user can touch it and get more information about that place. When the user is done with the birthplace information, he/she can instantly return to the biography and continue reading. It's just like what is done in a book with "see... references" except that the reader doesn't have to look up the reference—it pops up when he/she simply touches the hypertext button. This is a valuable user interface technique.

15.6.1.4 Graphics

Graphics is the capability of a computer to draw pictures from a table of instructions—the technique is called *vector graphics*. The process of drawing a vector graphic picture is called *rendering*, and it can take into account the parameters of the current environment and draw the picture to suit the screen resolution and amount of screen space available for the picture. It is also possible to implement zooming or shrinking the image to show more or less detail. Further, vector graphics is very data-efficient compared to storing pictures in pixel form (see below).

The disadvantages of vector graphics is that the pictures are drawings and may

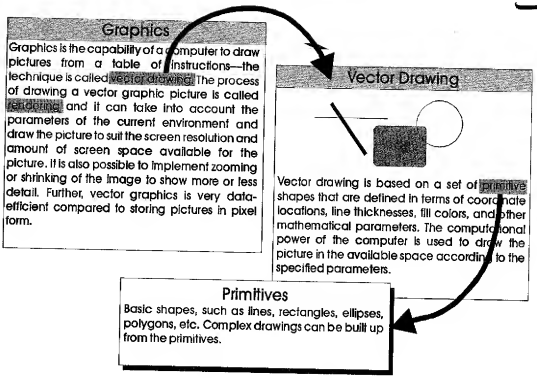

Figure 15.9 Hypertext.

not be realistic. Also with drawings, the result depends on the skill of the artist who did the original work.

15.6.1.5 Images

Pictures can also be displayed on a video screen by digitizing photographs or capturing stills from motion video. Both of these produce *bit-mapped* images, where the actual pixels to display are stored (of course, they can be compressed using JPEG or another still-compression technique—see Section 3.12). Bit-mapped images are very realistic as long as the image has enough pixels and enough colors.

Displaying bit-mapped images consists of decompressing if necessary, and copying the pixels to the desired location on the screen. Since the number of pixels in the image is fixed, the size of the image displayed depends on the total resolution of the screen being used. For example, a 640 × 480 image shows full-screen on a 640 × 480 display, but it will only be quarter-screen on a 1280 × 960 display. If a bit-mapped image is enlarged (zooming in), it will become blocky because the pixels become larger and easier to see.